64 Nature and Nurture

Genes help determine everything about you. But how big a role do they play? Magazine and newspaper articles often describe the impact of genes and the environment on the development of human traits. Sometimes these articles refer to this as the "Heredity vs. Environment" or "Nature vs. Nurture" debate. In fact, this is not a debate that one side will "win." Your genes and your environment *both* make you a unique person. Researchers would like to know more about how genes and the environment affect human traits.

Investigations of other organisms provide examples of how genes and the environment affect traits. The shapes of trees, the colors of hydrangea flowers, and the dark coloring at the tips of a Siamese cat's ears are all traits determined by both heredity and the environment. In this activity, you will use *Nicotiana* seeds to investigate how genes and the environment affect plant growth and development.

The cooler temperature at the tips of the cat's ears, face, paws, and tail is necessary for the dark color to develop, even though the gene for dark color is in every cell of the cat.

These hydrangea flowers can be either pink or blue, depending on soil conditions.

CHALLENGE **How does the environment affect the inherited green color trait in *Nicotiana*?**

MATERIALS

For each group of four students

- **12 *Nicotiana* seeds**
- **1 clear plastic petri dish**
- **1 black plastic petri dish**
- **2 pieces of germinating paper**
- **1 cup of water**
- **dropper**
- **scissors**
- **marking tape**
- **marking pen**

PROCEDURE

Part A: Planting the Seeds

1. Review the Materials list. With your group, design an experiment to test the effect of light on the inherited green color trait in *Nicotiana*.

   When designing your experiment, think about the following questions:

   - What is the purpose of your experiment?
   - What variable are you testing?
   - What is your hypothesis?
   - What variables will you keep the same?
   - What is your control?
   - How many trials will you conduct?
   - Will you collect qualitative and/or quantitative data? How will these data help you form a conclusion?
   - How will you record these data?

2. Record your hypothesis and your planned experimental procedure in your science notebook.

3. Make a data table that has space for all the data you need to record. You will fill it in during your experiment.

4. Obtain your teacher's approval of your experiment.
5. Conduct your experiment and check your seedlings every day. As with your earlier experiment, wait until the seedlings are old enough for you to be able to see which color trait they have developed.

Part B: Analyzing Results

6. Collect your seedlings.
7. Observe your seedlings carefully to see if there are any differences. Record your observations in the data table you prepared when you set up your experiment.
8. Report your results to your teacher, as directed.
9. After analyzing your results, respond to the questions below.

ANALYSIS

1. Was your hypothesis correct? Explain.
2. What effect did heredity have in determining the color of the seedlings?
3. What effect did the environment have in determining the color of the seedlings?
4. Can heredity alone ensure that an organism will grow well and be healthy? Explain.
5. Can the environment alone ensure that an organism will grow well and be healthy? Explain.
6. **Reflection:** What role do you think genes and the environment play in human development and health? Explain your thinking and give some examples.

EXTENSION

For a larger sample size, view the data gathered by fellow students from other locations. Go to the *Issues and Life Science* page of the SEPUP website for instructions.